



Western River Basin District

Forest and Water

SUPPORT DOCUMENT TO WATER MATTERS REPORT JUNE 2007



***Diffuse Acidification
Diffuse Eutrophication
Diffuse Sedimentation
Dangerous Substances***

June 2007

PROGRAMME OF MEASURES

FOREST AND WATER

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1. Background

Aspects of forestry have been identified under the Article 5 National Summary Characterisation Report (www.wfdireland.ie) risk assessment process as potential pressures acting on water bodies. The main areas of concern relate to:

- Acidification: forest canopies can capture sulphur and nitrogen compounds from the atmosphere. Rain becomes more acidic as it passes through the canopies to the ground below, and may worsen the chemical balance of receiving waters
- Nutrient enrichment: forestry activities can introduce extra nutrients which, in naturally nutrient-poor areas, can lead to problems such as algal growth
- Sedimentation: road-making and stream-crossing from activities such as planting and harvesting can cause erosion and sedimentation on susceptible soils. Mobile sediments may reduce water quality or damage sensitive areas
- Flow pattern changes: the amount of water reaching the soil surface is reduced by evaporation of water intercepted by the canopy. Clearfelling of forests may lead to a change in flow patterns
- Pesticide contamination: incorrect application of pesticides may result in contamination of waters.

The characterisation report identified significant gaps in the understanding of the interaction of forests and forestry activities and water quality and as a result the level of confidence in the risk assessment of forestry was low resulting in many water bodies being categorised as 'probably at risk' and 'probably not at risk'.

Additionally, the extent of potential impact of forests and forestry could not be fully evaluated as the information on forest cover in the Forest Inventory and Planning System dated from 1998 (FIPS98) was out of date and did not reflect the extensive private forest plantation that has occurred since 1985.

The Forest Service of the Department of Agriculture have developed Codes of Good Forestry Practice and a suite of guidelines pertaining to protection of the environment to ensure sustainable forestry management in harmony with environmental protection needs (see Western RBD Legislation and Policy Review on www.westernrbd.ie). The effectiveness of these guidelines and codes of practice needs to be evaluated.

2. STUDY OBJECTIVE

The primary objective is to assess the potential impact of afforestation and forest operations on water quality in river, lake, transitional and coastal water bodies and to develop an updated risk assessment methodology. This will provide a better understanding of the interaction and impact of forests and forestry activities on water quality and will resolve the uncertainties in Ireland's Article 5 Characterisation Report with respect to the identified potential impacts of acidification, eutrophication, hydrological and use of dangerous substances.

The second objective is to inform and develop a suitable Programme of Measures to achieve compliance with the WFD where this is required.

3. APPROACH AND METHODOLOGY

The approach and methodology were agreed by a Steering Group established for the project and the work is being undertaken in a series of work packages as follows:

- Work package 1 - Overview of Research and Baseline Information
- Work package 2 - Update Acid Sensitive Areas Map/ Acidification Impact and Potential Impact Map
- Work package 3 - Monitoring and Fieldwork for Acidification, Eutrophication and Sedimentation
- Work package 4 – Priority Substances and Priority Pollutants Register of Use
- Work package 5 - Update the National Risk Assessment and Measures

4. DISCUSSION OF TASKS AND PROGRESS

WP1: Overview of Research and Baseline Information

It is important to establish the extent of data and information available through past research and activities completed, in process or planned both nationally and internationally which could be used to inform the further characterisation process. The process of further characterisation is complex and every effort must be made to avoid duplication of past activities and make best use of the lessons learned.

A comprehensive literature overview is essential to provide a scientific basis for the approach to additional research and fieldwork that is required to obtain a better understanding for forests and water and to ensure unnecessary duplication of previous work does not occur. The issue of the interaction of forest cover on ecology and water quality is not unique to Ireland. Similar issues have emerged in Scotland and other countries. Relevant research and approaches undertaken in these locations need to be included in the review process.

Progress to date

A draft potential acid sensitive area national map has been prepared using updated subsoil data prepared by Teagasc and updated national bedrock data prepared by the GSI. The approach taken, using a GIS based analysis, has been to integrate areas which are deemed to be potential high risk of acid sensitivity i.e. where non calcareous bedrock is overlain by acid type soil (Figure 1).

	A	B	C	D
1	ROCKUNIT_Gchem	SUBSOIL_Gchem	ACID_Setting	ACID Risk
2	NON-Calc	Acid	Non-Calc Acid	HIGH
3	NON-Calc	not-stated	Non-Calc ns	HIGH
4	NON-Calc	Basic	Non-Calc Basic	MOD
5	Mod-Calc	Acid	Mod-Calc Acid	MOD
6	Mod-Calc	not-stated	Mod-Calc ns	MOD
7	Very-Calc	Acid	Very-Calc Acid	MOD
8	Mod-Calc	Basic	Mod-Calc Basic	NOT
9	Very-Calc	Basic	Very-Calc Basic	NOT
10	Very-Calc	not-stated	Very-Calc ns	NOT

Figure 1 – GIS Table based on overlay of non calcareous bedrock with acid soil type

An example of the result of this analysis is provided in Figure 2 which shows the resultant draft acid sensitive areas map for the Western River Basin District area.

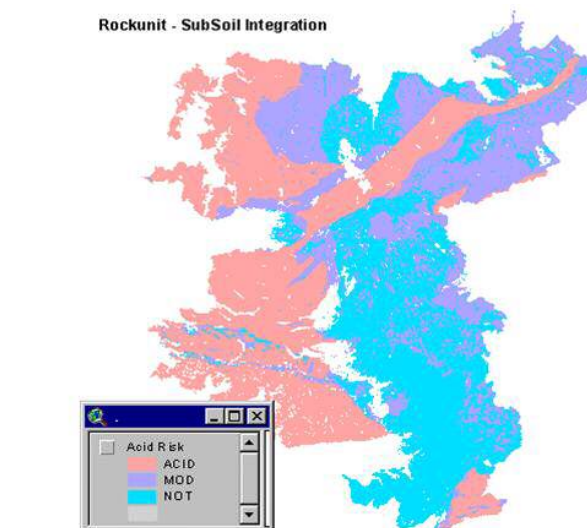


Figure 2 – Rock Unit –subsoil integration Western RBD

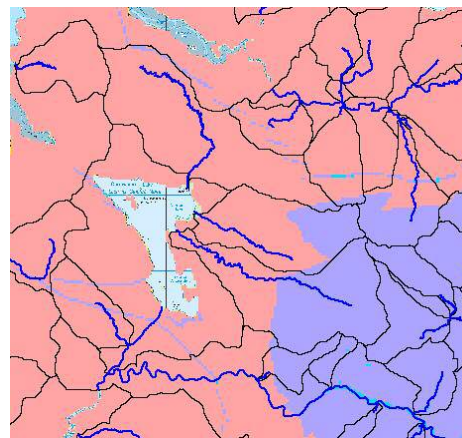


Figure 3 – Rock Unit –subsoil integration Western RBD

However, this does not provide the full picture, as even within the areas identified as being potentially acid sensitive there are areas of calcareous geology which may significantly buffer the water chemistry of waters passing through them. Refinement of the map is therefore necessary and is now being undertaken using:

- historic water chemistry data (pH, alkalinity and hardness) obtained from the EPA, Local Authorities, Fisheries and published reports. This data is being validated, geo-referenced and compiled (Figure 4). Data collection and geo-referencing is ongoing.
- Catchment areas of EPA monitoring sites with relevant data (Figure 5)
- Review of groundwater chemistry ranges with the GSI
- Data provided by the Forest Service.

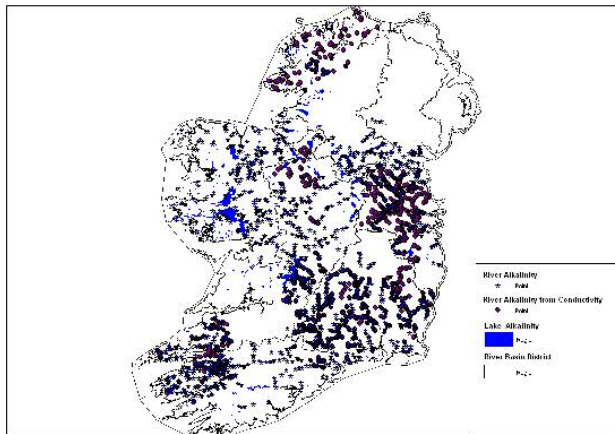


Figure 4 National geo-referenced chemistry data

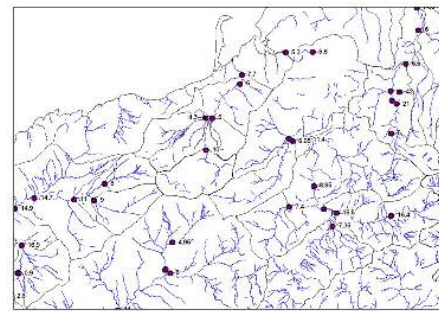


Figure 5 Monitoring point catchments

The monitoring data from field surveys being undertaken will be used to further validate the acid sensitive areas map

WP3. Monitoring and Fieldwork for Acidification, Eutrophication and Sedimentation

The objective of the fieldwork is to provide additional information to refine issues and gaps identified in previous research work and provide a national picture.

Closed forest canopies can give rise to acid impact in acid sensitive areas. Afforestation and forest operations can give rise to nutrient and sediment release at a number of stages during the forest cycle:

- Site preparation for both afforestation and reforestation
- Fertilization for crop establishment and maintenance
- Harvesting and associated road construction.

However the potential impact on receptor water bodies will depend on factors such as tree species, soil type, inherent soil P status, slope and runoff, weather conditions at the time of the operation, vegetation and presence of undisturbed buffer zones. Soil type is critically important. Peaty soils have little or no capacity to hold P and would therefore constitute areas of high risk potential whereas mineral soils will have high capacity depending on their history of fertilisation and are generally low risk.

Fieldwork study areas were selected using agreed criteria for sensitivity to acidification, eutrophication and sedimentation. The results:

- build on prior knowledge derived from previous and ongoing research work including the use of some of these sites as part of the fieldwork and validation process;
- are based on the WFD water body mapping and database of information, and
- utilise the new acid geology map.

The data from the fieldwork will be used to:

- Validate risk assessment;
- Refine risk assessment categories;
- Improve the map of acid sensitive areas;

- Determine actual impact and provide a basis for validation of acid sensitive areas map, predictive impact assessment and risk assessment procedure.

Progress to date

Site characterisation for target areas was first developed using GIS and potential sampling locations in each study area were identified. National sites were selected, based on the agreed criteria, to establish the potential impact from forest operations. These included control sites. Sites were selected to provide as wide a variation as possible in terms hydrogeological settings, soil and subsoil type and forest cover. Preliminary field visits were undertaken to target locations to confirm site suitability.

Acidification fieldwork

This fieldwork includes assessment of macroinvertebrate diversity (about 130 sites), water chemistry (280 sites) and fish (40 sites). Macroinvertebrate sampling has been completed and water chemistry and fish stock assessments are ongoing.

Eutrophication and sedimentation fieldwork

This work includes assessment of macroinvertebrate diversity, water chemistry and fish at over 100 sites. Analysis of the data will be correlated with forestry activity in the target catchments using data supplied by Coillte.

WP 4 – Priority Substances and Priority Pollutants Register of Use

Both insecticides and herbicides are used in forestry practice in Ireland. The use of such pesticides is authorised by the Pesticide Control Unit (PCS) of the Department of Agriculture and Food, which is the Regulatory Authority with respect to plant protection products in Ireland and through the Forest Stewardship Consul (FSC). The authorisation of use for such plant protection products is administered through Council Directive 91/414/EEC¹ concerning the placing of plant protection products on the market.

Insecticides are used to control the large pine weevil, *Hylobius abietis*, the only insect pest of forestry across Europe against which routine protective measures are required. Post clearfelling of conifer crops, particularly pines, the pine weevil breeds in the remaining stumps. Emerging as adults about one year later they feed on the bark and underlying tissue of newly planted trees. Crop losses can be as high as 95% if infestation is left unchecked.

Herbicides are used to control weeds which are the most common and persistent threat of young tree crops.

This task is required to develop a Register of Potential Dangerous Substances/Priority Substances to the extent possible, based on available information in use or used by the Forest Sector, to include:

- Type
- Application rates

¹ **COUNCIL DIRECTIVE of 15 July 1991 concerning the placing of plant protection products on the market (91/414/EEC) (OJ L 230, 19.8.1991, p. 1)**

- Half-life
- Toxicity to fish and aquatic invertebrates
- Period of Use.

This data is required to establish the nature and extent of the use of such materials by the Forest Sector and to include the most relevant materials in the National WFD Monitoring Programme.

Progress to date

Data on pesticide use, both herbicide and insecticide, for a typical year with respect to the State Forests was provided by Coillte. A database of the range of pesticides used (Table 1), quantity of material and areas of application was developed and mapped.

Table 1 Range of Pesticides used by Coillte, 2005

Type	Active ingredient	Product	Amount of active ingredient (g/l)
Insecticide	alpha-cypermethrin	Agromethrin	40
Insecticide	alpha-cypermethrin	Bestseller	100
Insecticide	cypermethrin	Forester	100
Insecticide	carbosulfan	Marshal suSCon granules	10%*
Herbicide	asulam	Asulox	400
Herbicide	atrazine	Atrazine	500
Herbicide	glyphosate	Roundup	360
Herbicide	glyphosate	Biactive	360
Herbicide	glyphosate	No-Mix Hilite	144
Herbicide	imazapyr	Arsenal	250
Herbicide	triclopyr	Garlon 2	240

* applied as a solid

Pine weevil attack is primarily controlled through use of insecticides. The main insecticide used (2006) for this purpose is cypermethrin, a synthetic pyrethroid. Other pyrethroids used in the control of pine weevil in the past included permethrin and alpha-cypermethrin, the latter still in use in some areas.

Application of the insecticide is generally made at two stages, pre planting (dipping) and post planting (spraying). Pre dipping reduces the requirement for spray application in the field. The use of insecticides, such as permethrin, is associated almost entirely with clearfelling and replanting activities associated with State owned forestry. State planting increased in the 1920's and increased significantly from 1950 on. Given the normal time to harvest of 40+ years, it is primarily state owned forestry which is being clearfelled and replanted. By contrast private afforestation has only increased significantly since the 1990's and significant harvesting will not occur until post 2030.

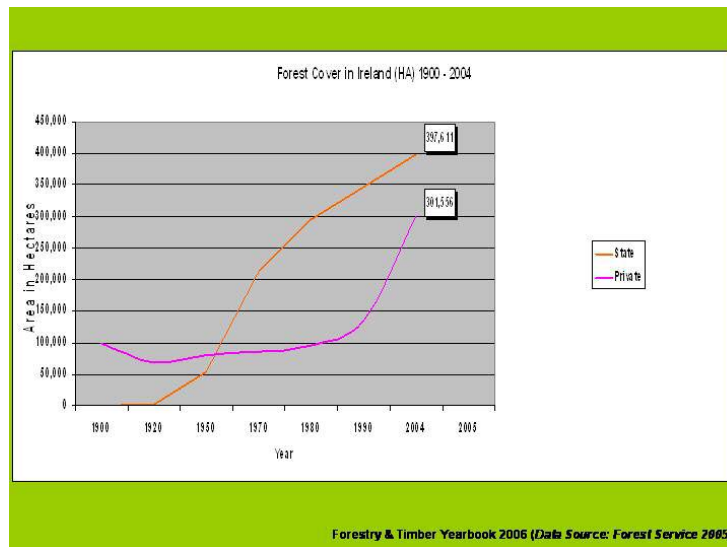


Figure 6 State vs Private Planting in Ireland

Herbicides are used by both the state and private sector and are particularly important for control of weed growth in broadleaf plantations in the early years. The principal herbicide used is glyphosate. Data is lacking on the use of herbicides by the private sector but their use is expected to be similar to that of state owned properties.

Ecotoxicity data has been obtained for the range of insecticides and herbicides indicated as being used by the forest sector. This data was obtained from Material Safety Data Sheets for the materials used, the Pesticide Action Network database and EU Pesticide Review Reports initially and additional information has been identified from sources such as the European Chemical Substances Information system, Footprint pesticides database, US EPA Ecotox database.

A report on the use of priority pesticides by the Forest Sector has been prepared by the Forest and Water Project and forwarded to the Dangerous Substances Usage Working Group. The information in the report has been used to inform the national WFD monitoring programme.

WP5 - Update the National Risk Assessment and Measures

Data from work packages 1 – 4 will be used to test and validate updated risk assessment methodologies for forestry and water.

The information provided will also provide an assessment of the existing measures (such as the Code of Good Forestry Practice and Forestry Guidelines) in use to protect the environment from forest activities. This will identify whether existing measures are adequate or whether modifications to existing measures are required.

The Forest and Water project presently uses the FIPS98 Forest Inventory and Planning System database to guide research and monitoring. FIPS98 is limited largely to the Coillte forest areas, some private forest areas and natural woodlands. It does not reflect the private afforestation which has been grant aided under the forest premiums schemes which now comprise up to 40% of national forest cover or the changes which have occurred in the Coillte managed areas. The project is working closely with the Forest Service in the Department of Agriculture to complete the new National Forest Inventory and Planning System (FIPS2006). This will provide a more comprehensive understanding of the potential pressure from forests and forestry and

will allow more accurate updated potential impact maps of forest acidification, eutrophication, sedimentation and use of priority substances.

Additional activities

In addition to the planned Work Packages outlined above the Forest and Water Project has undertaken the following additional tasks:

National Monitoring Programme

As part of the development of the WFD National Monitoring Programme, the group developed a methodology for site selection of monitoring locations and identified sites for inclusion in the monitoring programme. The sites were selected to represent forest and water reflecting geographic spread, varying hydrogeology, soil and subsoil types and varying tree species and degree of cover. The recommendations were provided to the EPA.

Workshop

An international workshop on riparian zone management in forestry was held in Wexford in March 2007. The importance, feasibility and limitations of using riparian buffer zones in forestry as a control measure for silt and phosphorus were discussed.

Public Awareness

The Forest and Water Project has an active programme of promoting awareness of the project and the issues which it seeks to address. The study has arranged workshops and information meetings with the Forest Service and representatives of the Forestry Sector in general. The project will continue to develop public awareness in this manner.